Space Weather Technical Forecast

Issued on Tuesday, 25 October 2022 at 13:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of R1 Radio blackouts. Increasing chance of Active electron fluence. G1/Minor Storms possible on 28 October.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with two C-class flares from AR3126 in the southwest quadrant. This region remains slightly complex. AR3130 in south centre disk is now beginning to fade. AR3131 close the northeast limb appears to be a weak returning feature, and despite currently appearing benign, will be monitored for further developments and activity. No Earth-directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind parameters, as observed by DSCOVR at L1, were indicative of a gradual exit from the HSS of CH34/-. Solar wind speeds fell from 520-420 km/s. Density was average or below. Total magnetic field strength was weak, with the north-south component, Bz, varying between positively weak and negatively weak. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was generally Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at normal background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.43e6 integrated pfu observed at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low or Very Low with a chance of M-class flares.

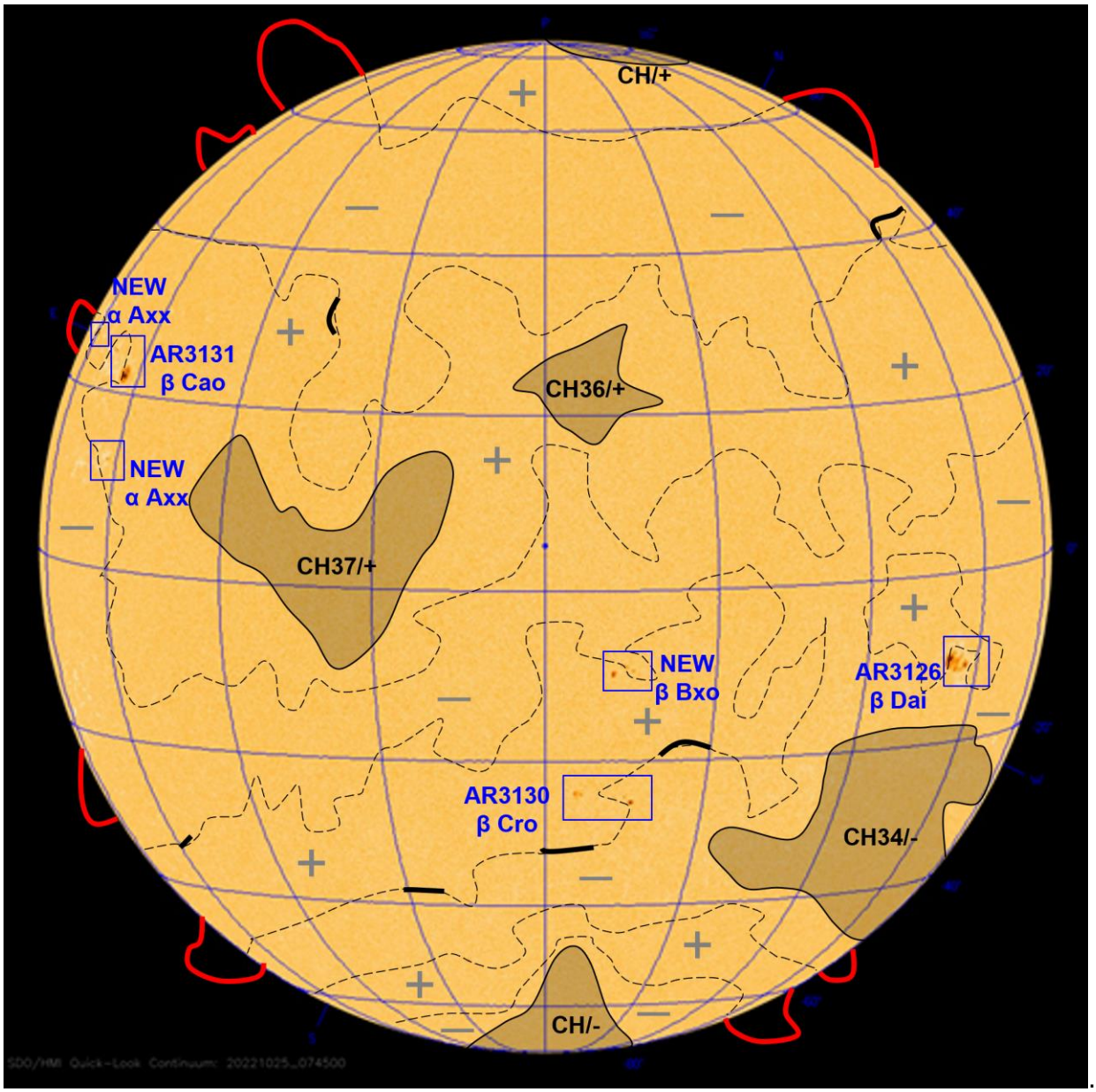
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs have been observed. The Earth is expected to continue exiting the HSS from CH34/- through days 1-3 (25th-27th), with speeds falling to background levels. An increase is then expected early on day 4 (28th) as the Earth connects with the HSS from CH36/+. Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals days 1-3 (25th-27th). Day 4 (28th) will see a chance of Active or G1/Minor Storm intervals, as the Earth connects with the HSS of CH36/+.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background. High energy electron flux (greater than 2MeV) is expected to be mainly background to moderate levels at first, but is expected to trend towards mainly high levels through 26 and 27 October as the high speed stream eases. Further reductions are then possible from 28 October due to a further high speed stream and resultant belt compression. Electron fluence values are forecast to begin trending slowly upwards towards the Active threshold from 26 October.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 1. Solar Analysis Valid 25/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

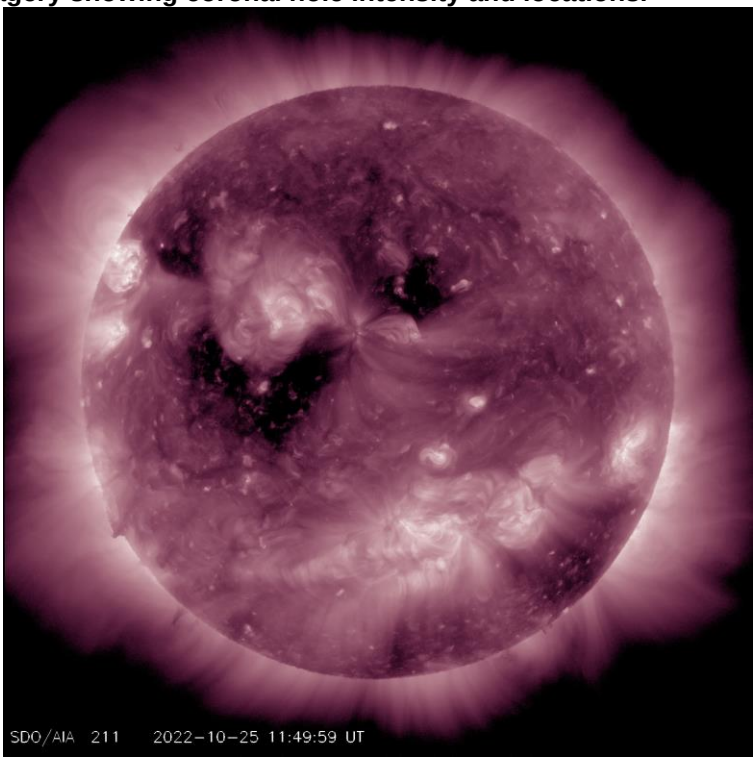
No Earth-directed CMEs are currently forecast.

The Earth is expected to continue exiting the HSS from CH34/- until 28th Oct, with speeds falling to background levels. An increase in solar wind speeds is then expected early on 28th Oct as the Earth connects with the HSS from CH36/+. On the last rotation this feature produced speeds of around 500-550 km/s, and in the absence of STEREO A data, similar speeds are forecast on this occasion. Connection to the high speed stream is forecast for either late on 27 October or more likely during 28 October.

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals until 28th October. On 28th October there is a chance of Active or G1/Minor Storm intervals, as the Earth connects with the HSS of CH36/+, with this polarity favoured for stronger connections around the September equinox.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: AIA 211 imagery showing coronal hole intensity and locations.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

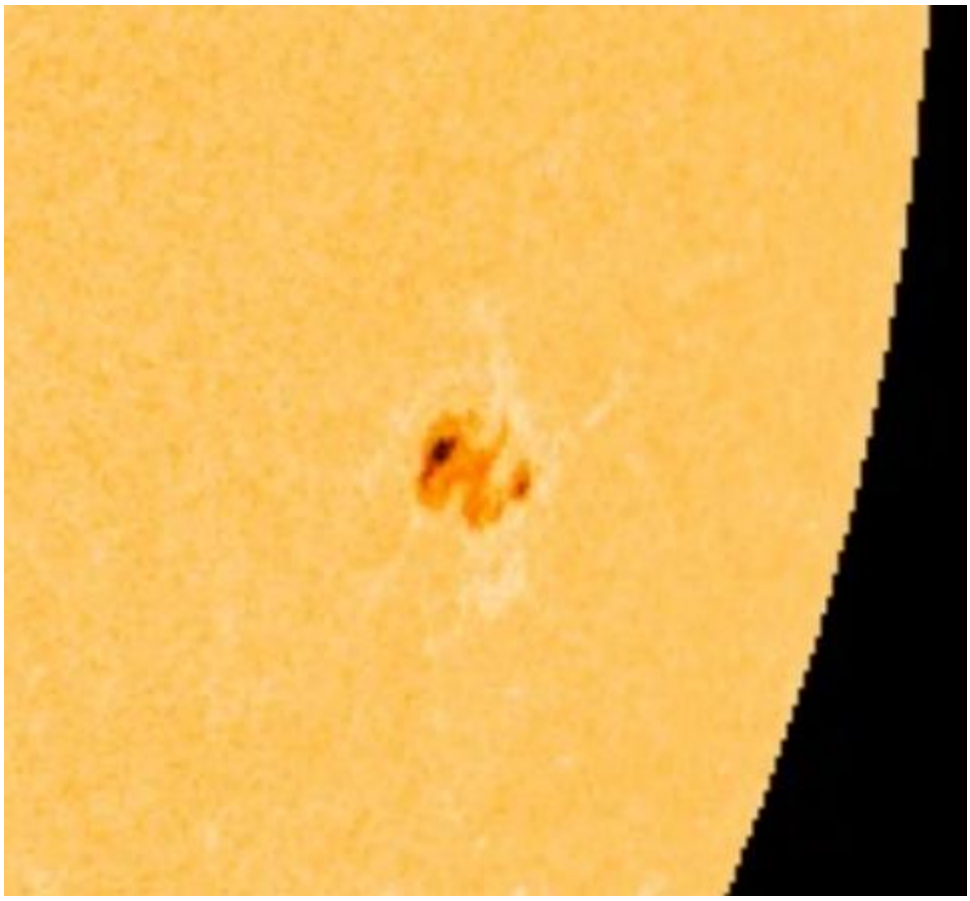
Radio Blackouts - X-Ray Flares:

Solar activity has been Low with three numbered and three unnumbered sunspots on the visible disc. All three numbered sunspots are of modest size, with AR3126 the most active, albeit with limited C-class flare activity. AR3131 has rotated onto the northeast of the solar disc and despite an initially benign appearance, as a returning feature, enhanced activity is considered a possibility.

Low or Very Low activity is expected with a chance of M-class flares, mainly from AR3126.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	20	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: SDO intensitygram showing AR3126 at 25/1200 UTC



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background and expected to stay at this level with no significant active regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has been close to background levels through the last 24 hours, likely due to the compression exerted on the radiation belts from the current high speed stream. This is likely to be compressing the belts out of their natural orbits, resulting in the measurements observed at GOES-16. As the high speed stream eases, likely on 26 October, electron flux levels are expected to increase towards high levels as the belts relax and electron inputs from the high speed stream become evident. The next high speed stream on 28 October may then have a similar effect of distorting the radiation belts.

Electron fluence values are expected to start increase from 26 October in line with apparent increasing flux levels, with a trend towards the Active (1e8 integrated pfu) threshold by the end of the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	50	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	2	5	5

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.